ENVIRONMENTAL ASSESSMENT
OF THE
ENDANGERED SPECIES MANAGEMENT PLAN
FOR
U.S. ARMY AVIATION AND MISSILE COMMAND,
REDSTONE ARSENAL, ALABAMA

U.S. ARMY AVIATION AND MISSILE COMMAND
REDSTONE ARSENAL, ALABAMA

DECEMBER 29, 1999

29 December 1999

**FINDING OF NO SIGNIFICANT IMPACT (FNSI)
FOR THE ENVIRONMENTAL ASSESSMENT OF THE
ENDANGERED SPECIES MANAGEMENT PLAN
FOR
U.S. ARMY AVIATION AND MISSILE COMMAND,
REDSTONE ARSENAL, ALABAMA**

BACKGROUND: Redstone Arsenal (RSA) is located in Madison County, Alabama, southwest of and adjacent to the City of Huntsville, Alabama. Prior to acquisition by the Army, the land comprising the current RSA was used for producing cotton, corn, hay, small grain crops, and livestock. The original land was purchased in 1941-1942 from 320 landowners under the Siebert Arsenal Project. Under this project, the Huntsville Arsenal and Redstone Arsenal were constructed to manufacture chemical munitions. The two Arsenals were eventually combined into the current RSA in 1949 with an approximate 32,000 acres. Over the ensuing years, acreage has been increased and reduced during various transactions. Redstone Arsenal is currently comprised of 37,910 acres (including special-use permit land) located on a site approximately six miles wide by ten miles long.

DESCRIPTION OF THE PROPOSED ACTION: The Proposed Action is to implement the Redstone Arsenal Endangered Species Management Plan (ESMP) in a timely, consistent, and effective manner. Redstone Arsenal, in its entirety, is covered by the ESMP. The ESMP for RSA describes the listed and proposed endangered and threatened species found on the Installation, conservation goals, management prescriptions, monitoring and inventory programs, and funding requirements for plan implementation. The plan would serve as a guide for the conservation of biological diversity through the protection of listed, proposed and candidate species and the associated critical habitats.

ALTERNATIVES CONSIDERED: The only alternative considered to the Proposed Action, was the No-Action Alternative. Under this alternative, the Army would not implement the ESMP. Without implementation of the ESMP, there would be no concise, comprehensive procedures in place to conserve the listed and candidate threatened and endangered species and critical habitats present on the Installation.

ENVIRONMENTAL EFFECTS: Eleven broad environmental components were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the significance of potential impacts. The areas of environmental consideration are air quality, biological resources, cultural resources, hazardous materials and waste, health and safety, infrastructure and transportation, land use, noise, geology and soils, socioeconomics, and water resources.

Cumulative impacts of the Proposed Action, with respect to each of these environmental components, were also analyzed.

The Proposed Action would have potentially positive impacts to biological and water resources. Positive cumulative impacts would be expected in the area of biological resources. There would be no anticipated significant negative impacts to the other environmental resources considered. Any determined impacts to the environment would be mitigable.

If the No-Action Alternative were selected, the ESMP would not be implemented. There would be no comprehensive management plan for endangered or threatened species and their associated habitats on RSA. The Arsenal would experience a potential loss of suitable floral and faunal habitats for threatened and endangered species, and jeopardize the number of listed and candidate species living on the Installation. The Endangered Species Act specifically prohibits any action that would adversely impact the continued existence of listed species as a result of habitat modification, "take" of fish or wildlife species, or destruction of plant species. Under the No-Action Alternative, potential adverse impacts would be expected to biological resources.

CONCLUSION: The Redstone Arsenal Directorate of Environmental Management and Planning has prepared an environmental assessment that addresses the Proposed Action and evaluates its potential for environmental impacts. Based on the Environmental Assessment of the Endangered Species Management Plan for U.S. Army Aviation and Missile Command, Redstone Arsenal, Alabama, 20 July 1999, we conclude that there would be no significant environmental impacts associated with this action that would require the publication of an Environmental Impact Statement. Should you wish to review this Environmental Assessment or comment on this action, you may contact Ms. Pam Rogers, 256-876-4162, Commander, U.S. Army Aviation and Missile Command, Attn: AMSAM-IN (Ms. Pam Rogers), Redstone Arsenal, Alabama, 35898-5020, within thirty days of the date of publication of this document.

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION AND MISSILE COMMAND
REDSTONE ARSENAL, ALABAMA

FINDING OF NO SIGNIFICANT IMPACT FOR THE ENVIRONMENTAL ASSESSMENT OF THE ENDANGERED SPECIES MANAGEMENT PLAN

PREPARED 29 DECEMBER 1999

PROPONENT OF THE ACTION:

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EXECUTIVE SUMMARY

INTRODUCTION

Redstone Arsenal (RSA) is located in Madison County, Alabama, southwest of and adjacent to the City of Huntsville, Alabama. Prior to acquisition by the Army, the land comprising the current RSA was used for producing cotton, corn, hay, small grain crops, and livestock. The original land was purchased in 1941-1942 from 320 landowners under the Siebert Arsenal Project. Under this project, the Huntsville Arsenal and Redstone Arsenal were constructed to manufacture chemical munitions. The two Arsenals were eventually combined into the current RSA in 1949 with an approximate 32,000 combined acres. Over the ensuing years, acreage has been increased and reduced during various transactions. RSA currently comprises 37,910 acres (including special-use permit land) located on a site approximately six miles wide by ten miles long.

DESCRIPTION OF PROPOSED ACTION

The Proposed Action is to implement the Endangered Species Management Plan (ESMP) for Redstone Arsenal, Alabama, in a timely, consistent, and effective manner. Redstone Arsenal, in its entirety, is covered by the ESMP. The ESMP for RSA describes the listed and proposed endangered and threatened species found on the Installation, ecologically sensitive areas, and conservation goals for these species and associated habitats, management prescriptions, monitoring and inventory programs, and funding requirements for plan implementation. The plan would serve as a guide for the conservation of biological diversity through the protection of listed, proposed, and candidate species and the associated critical habitats.

METHODOLOGY

The purpose of this Environmental Assessment (EA) is to analyze the potential environmental consequences of the Proposed Action in compliance with the National Environmental Policy Act (NEPA); Department of Defense Directive 6050.1, *Environmental Effects in the United States of Department of Defense Actions*; and Army Regulation (AR) 200-2, *Environmental Effects of Army Actions*.

Eleven broad environmental components were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the significance of potential impacts. The areas of environmental consideration are: air quality, biological resources, cultural resources, hazardous materials and waste, health and safety, infrastructure and transportation, land use, noise, geology and soils, socioeconomics, and water resources.

To assess the significance of environmental impacts, a list of activities necessary to accomplish the Proposed Action was developed. The environmental setting was then described and those activities with the potential for significant environmental consequences were identified. The significance criteria used to evaluate the environmental effects of program activities include three levels of impacts: no impact, no significant impact, and significant impact.

RESULTS

This section summarizes the conclusions of the analyses made for each of the 11 areas of environmental consideration based on the application of the described methodology.

AIR QUALITY - There would be no significant impacts to air quality expected from implementing the ESMP. Federal and state ambient air quality standards concentration criteria would not be exceeded due to ESMP implementation.

BIOLOGICAL RESOURCES - There would be positive cumulative impacts to biological resources and biodiversity expected from implementing the ESMP.

Vegetative Communities - Implementing the ESMP would improve sustainability of healthy, diverse, and productive plant resources on the Installation and result in overall positive benefits to resident populations of Price's potato-bean and Harper's umbrella plant.

Fish and Wildlife Communities - Implementing the ESMP would improve the sustainability of healthy, diverse, and productive animal communities, reflective of a naturally balanced ecosystem.

Aquatic Resources - Aquatic habitats and the broad range of species found in the 10,000 acres of the Arsenal affected by the Tennessee River and other tributary systems would be managed and improved to further support habitat and species biodiversity in the region of influence and beyond.

Threatened and Endangered Species - Implementing the ESMP would specifically benefit threatened and endangered flora and fauna indigenous to RSA and their habitats.

CULTURAL RESOURCES - There would be no significant impacts expected to cultural resources from implementing the ESMP. During ESMP activities, any items observed that might have historical or archaeological value would be reported immediately to Arsenal Cultural Resource personnel so that the Cultural Resource Manager may determine their significance and any special disposition of the finds. Activities in the area of the discovery that may result in destruction of these resources would cease and personnel would be prevented from trespassing on, removing, or damaging such resources.

HAZARDOUS MATERIALS AND WASTE - Hazardous materials would not be used under the ESMP. Therefore, no impacts are expected.

HEALTH AND SAFETY – No impacts to Health and Safety would result from the implementation of the ESMP.

INFRASTRUCTURE AND TRANSPORTATION - There would be no significant impacts expected to infrastructure and transportation from implementing the ESMP. Through the conservation measures for Price’s potato-bean, access has been restricted to Madkin Mountain.

LAND USE - There would be no significant impacts expected to land use from implementing the ESMP. Minor changes to low impact training activities would occur in the vicinity of sensitive

species. A small acreage would be converted from agricultural lease to non-commercial forestry in the vicinity of Bobcat Cave.

NOISE – No impacts to noise levels would be anticipated by the implementation of the ESMP.

GEOLOGY AND SOILS - There would be no impacts to geology and soils from implementing the ESMP.

SOCIOECONOMICS - There would be no impacts expected to socioeconomics from the implementation of the ESMP.

WATER RESOURCES - There would be minor positive impacts to water resources expected from implementing the ESMP. Water quality monitoring would be conducted quarterly in the vicinity of Bobcat Cave. This would allow for timely reaction to potential groundwater contamination in this area.

CONCLUSION

The Proposed Action (Alternative 1) would effectively manage and preserve Redstone Arsenal's threatened and endangered species as required by federal, state, local, DoD, and Army regulations. If the Proposed Action is selected, Redstone Arsenal would implement the ESMP in a timely, consistent, and effective manner. The ESMP describes the Installation's endangered species management requirements, outlines the resources necessary for surveillance and control, and describes the administrative and environmental requirements of the program. The plan would serve as a guide for maintaining the conservation of biological diversity through the protection of listed, proposed, and candidate species and the associated critical habitats.

The Proposed Action would have potentially positive impacts to biological and water resources. There would be no anticipated significant negative impacts to the other environmental resources considered. Identified impacts to the environment are not considered to be significant and would be mitigable.

If the No-Action Alternative were selected, the ESMP would not be implemented. There would be no comprehensive endangered species management plan for RSA. The Arsenal would potentially violate the Endangered Species Act and associated regulations if listed or candidate endangered or threatened species and their habitats were jeopardized. Under the No-Action Alternative, potential adverse impacts would be expected to biological resources.

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CHAPTER 1.0
INTRODUCTION

The National Environmental Policy Act (NEPA); the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508); Department of Defense (DoD) Directive 6050.1, *Environmental Effects in the United States of Department of Defense Actions* (U.S. Department of Defense 1979); and AR 200-2, *Environmental Effects of Army Actions* (U.S. Department of the Army 1988), which implements these laws and regulations, direct DoD and Army officials to consider environmental consequences when authorizing or approving federal actions. Accordingly, this environmental assessment (EA) analyzes the environmental consequences of the Endangered Species Management Plan (ESMP) (July 1999) for the U.S. Army Aviation and Missile Command, Redstone Arsenal, Alabama.

Section 1.0 of this EA discusses the background and gives a brief description of the Proposed Action, introduces the purpose of and need for the action, notes the location of the project, and highlights issues raised during the assessment process. Section 2.0 discusses project alternatives including the Proposed Action and compares the environmental consequences of the alternatives. Section 3.0 describes the affected environment at the location of the Proposed Action. Section 4.0 assesses the potential environmental consequences of implementing the Proposed Action and alternatives; it also highlights cumulative impacts and mitigation measures for each resource. Section 5.0 highlights the conclusions of the assessment. Section 6.0 contains a list of preparers for this EA. Section 7.0 lists the individuals and agencies consulted during the preparation of this EA and the agencies, organizations, and individuals that were provided a copy of the EA. Section 8.0 contains a list of the references used to prepare this document.

1.1 Background

RSA is located in Madison County in north-central Alabama (Figure 1-1), southwest of and adjacent to the City of Huntsville, Alabama. The Installation is located in the Tennessee Valley in the southwestern portion of Madison County. It is bounded by the Tennessee River on the south, the City of Huntsville to the north and east, the City of Madison to the west, and Wheeler National Wildlife Refuge (WNWR) to the southwest. Prior to acquisition by the Army, the land comprising the current RSA was used for producing cotton, corn, hay, small grain crops, and livestock. The original land was purchased in 1941-1942 from 320 landowners under the Siebert Arsenal Project. Under this project, the Huntsville Arsenal and Redstone Arsenal were constructed to manufacture chemical munitions. The two arsenals were eventually combined into the current RSA in 1949 with an approximate 32,000 combined acres. Over the ensuing years, acreage has been increased and reduced during various transactions. Redstone Arsenal is currently comprised of 37,910 acres (including special-use permit land). RSA is roughly rectangular, approximately 60 square miles in area (ten miles long by six miles wide), and employs approximately 29,000 government and contractor personnel.

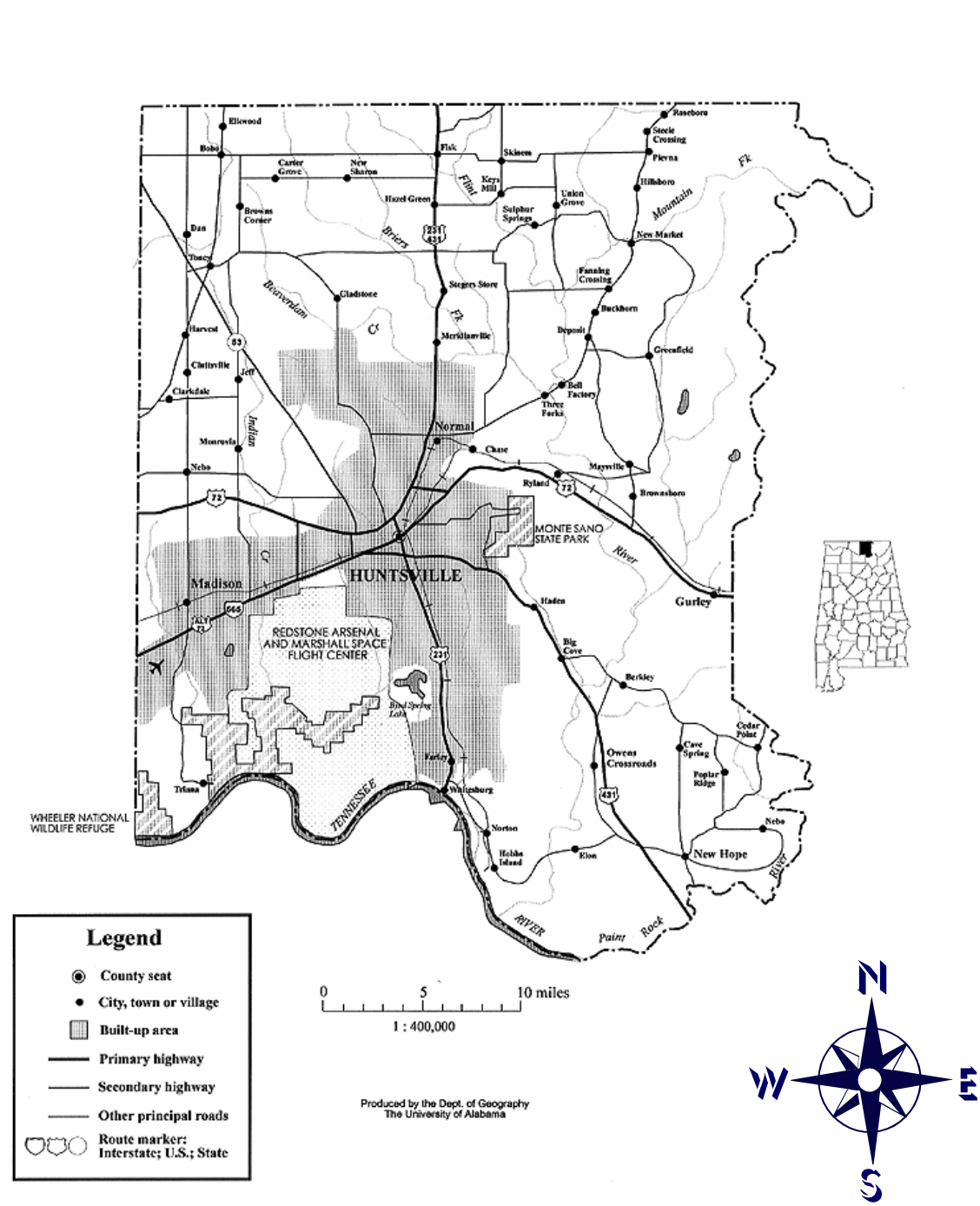

Figure 1-1 Redstone Arsenal Locator Map

1.1.1 Description of the Proposed Action

The Proposed Action is to implement the ESMP (July 1999) in a timely, consistent, and effective manner. Redstone Arsenal, in its entirety, is covered by the ESMP. The ESMP consists of four sections. Section One provides an introduction and general overview of the Plan. Section Two describes federally listed as endangered, threatened or proposed species and the conservation measures and goals, management prescriptions, monitoring plan, and projected costs associated with implementing the management of the species. Section Three contains the management practices associated with unique or unusual species inhabiting the Installation that do not receive federal protection. Section Four of the ESMP describes other ecologically sensitive areas found on the Installation. The six appendices of the ESMP contain a glossary, related environmental studies, state regulations, the Federal Cave Resources Act, references, and individuals and organizations contributing to the development of the ESMP.

1.1.2 Purpose of and Need for the Action

The purpose of the ESMP is to provide guidance for operating and maintaining an effective endangered species management program. Species specifically addressed in the plan are the Alabama cave shrimp, Price's Potato-bean, the gray bat, the bald eagle, the Peregrine falcon, the American alligator, the dwarf trillium, Harper's umbrella plant, ginseng, and the Tuscumbia darter. Ecologically sensitive areas are also addressed in the ESMP. Principles of conservation of biological diversity are stressed in the plan.

The plan is needed as a guide for developing and maintaining Arsenal lands consistent with the military mission and national policies on conservation of biological diversity including endangered, threatened or candidate species as prescribed by AR 200-3, *Natural Resources Land, Forest, and Wildlife Management*; the Endangered Species Act; implementing regulations of the U.S. Fish and Wildlife Service (50 Code of Federal Regulations [CFR] Part 402); and Department of Defense Directive (DODD) 4700.4, *National Resources Management Program*.

1.1.3 Location

Redstone Arsenal, in its entirety, is the region of influence (ROI) covered by the ESMP. This area includes approximately 37,910 acres. The ESMP specifically addresses critical habitats and ecologically sensitive areas on the Installation.

1.2 Related Environmental Documentation

A list of related environmental documentation reviewed during the preparation of this EA is shown below.

- *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation*, U.S. Army Missile Command, Redstone Arsenal, Alabama, December 1994.
- *Natural Resources Management Plan for Redstone Arsenal, Parts I, II, III, IV, V, VI*, July 1995.
- *Endangered Species Management Plan for Redstone Arsenal*, U.S. Army Aviation and Missile Command, Redstone Arsenal, Alabama, July 20, 1999.

- *Natural Heritage Inventory of Redstone Arsenal: Federally Listed Endangered, Threatened, Candidate, and State-Listed Species.* Alabama Natural Heritage Program℠. Montgomery, Alabama. October 1995.

1.3 Agencies Involved in Environmental Analysis

Agencies and individuals consulted during the preparation of this EA are listed in Section 7.0.

1.4 Public Involvement

Public involvement would take place at the completion of this EA process. There would be a 30-day comment period after the Notice of Availability of the EA for the Endangered Species Management Plan for Redstone Arsenal, Alabama, is published in the local newspaper.

There were no significant issues determined through this EA process. All issues raised during the scope of the process have been identified within this assessment.

CHAPTER 2.0
ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Summary of Alternatives

During the planning stages for the ESMP, the No-Action alternative was the only alternative considered to implementing the ESMP. Implementing the Proposed Action and the No-Action Alternative were assessed for potential impacts to the environment and described in the following sections.

2.2 Description of Alternatives Including the Proposed Action

2.2.1 Alternative 1 - Proposed Action

The Proposed Action is to implement the ESMP (July 1999) in a timely, consistent, and effective manner. The ESMP for RSA describes the listed and proposed endangered and threatened species found on the Installation, conservation goals for these species and their associated habitats, management prescriptions, monitoring and inventory programs, and funding requirements for plan implementation. The plan is utilized as a guide for the responsible management of endangered, threatened, or candidate species and their critical habitats consistent with the military mission and federal, state, and local policies on endangered species management practices.

2.2.2 Alternative 2 - No-Action Alternative

If the No-Action Alternative were selected, the ESMP would not be implemented. There would be no comprehensive endangered species management plan for RSA. The Arsenal would potentially violate the Endangered Species Act and associated regulations if listed or candidate endangered or threatened species and their habitats were jeopardized. Under the No-Action Alternative, potential adverse impacts would be expected to biological resources, land use, geology and soils, and water resources.

2.3 Comparison of Environmental Consequences

The following sections discuss the environmental consequences of the alternatives considered within this EA. Table 2-1 provides a comparison of the potential environmental consequences associated with the implementation of the alternatives by individual resource. The information presented in this table is based on the environmental impact analysis presented in Section 4.0 of this EA. As outlined in Section 4.0, three levels of impact are defined.

- No Impact - No impact to the resource is predicted.
- No Significant Impact - An impact to the resource is predicted, but the impact does not meet the intensity/context significance criteria for the specific resource.
- Significant Impact - An impact for the resource is predicted that meets the intensity/context significance criteria for the specific resource.

Table 2-1: Comparison of Environmental Consequences Associated With Implementation of the ESMP

RESOURCE	PROPOSED ACTION	NO-ACTION ALTERNATIVE	CUMULATIVE IMPACTS	MITIGATION MEASURES
AIR QUALITY	---	---	**NONE**	**NONE**
BIOLOGICAL RESOURCES	**P**	**S**	**POSITIVE**	**NONE**
CULTURAL RESOURCES	---	---	**NONE**	**NONE**
HAZARDOUS MATERIALS AND WASTE	---	---	**NONE**	**NONE**
HEALTH AND SAFETY	---	---	**NONE**	**NONE**
INFRASTRUCTURE AND TRANSPORTATION	**X**	---	**NONE**	**NONE**
LAND USE	**X**	---	**NONE**	**YES**
NOISE	---	---	**NONE**	**NO**
GEOLOGY AND SOILS	---	---	**NONE**	**NO**
SOCIOECONOMICS	---	---	**NONE**	**NO**
WATER RESOURCES	**P**	---	**NONE**	**YES**

--- No Impact
X No Significant Impact
S Significant Adverse Impact
P Positive Impact

CHAPTER 3.0
AFFECTED ENVIRONMENT

This section describes the environmental resources that may be affected by the Proposed Action. The affected environment is described in order to provide a context for understanding the potential impacts. Those components of the affected environment that are of greater concern relevant to the potential impacts are described in greater detail.

Available literature (such as EAs and Installation master plans) was acquired, and data gaps (questions that could not be answered from the literature) were identified. To fill the data gaps and to verify and update available information, Installation personnel and federal, state, and local regulatory agencies were contacted. Cited literature, telephone interviews, and referenced material are presented in Section 8.0.

Eleven broad environmental components were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the significance of potential impacts. Federal and/or state environmental statutes, many of which set specific guidelines, regulations, and standards, regulate several of these environmental components. These standards provide a benchmark that assists in determining the significance of environmental impacts under the NEPA evaluation process. The compliance status of each project area with respect to environmental requirements was included in the information collected on the affected environment. The areas of environmental consideration are air quality, biological resources, cultural resources, hazardous materials and waste, health and safety, infrastructure and transportation, land use, noise, geology and soils, socioeconomics, and water resources.

3.1 AIR QUALITY

Region of Influence - The region of influence (ROI) for air quality is RSA and the immediately surrounding area.

Affected Environment - The Air Quality Act of 1967, commonly referred to as the Clean Air Act (CAA), was designed to protect and enhance the quality of the nation's air resources. This Act, along with amendments adopted in 1970, 1977, and 1990, serves as the basis for air quality standards. National Ambient Air Quality Standards (NAAQS), established by the Environmental Protection Agency (EPA), and mandated by the CAA, are the standards for ambient concentrations of the criteria pollutants. These pollutants include sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM-10), and lead (Pb). The NAAQS concentrations are ceilings that may not be exceeded. The NAAQS and Alabama Air Quality Standards are shown in Table 3-1. Areas are classified in one of three categories:

- Attainment - better air quality than required by standards;
- Non-attainment - worse air quality than required by standards; and
- Attainment unclassified - insufficient data available for the area to warrant non-attainment status and justify attainment status.

Criteria pollutants are those chemicals for which ambient air quality standards have been promulgated. These criteria pollutants are emitted primarily from combustion sources such as power plants, boilers, aircraft engines, automotive engines, solid waste incinerators, and burn pits.

These pollutants are regulated and controlled so that the concentration does not exceed either short-term or long-term standards. Under the CAA, federal actions must not cause or contribute to any new violation of air quality standards, increase the frequency or severity of any existing violation, or delay the timely attainment of any air quality standard or interim milestone.

Noncriteria pollutants are all other air pollutants that are regulated and controlled by emission standards or other health-risk-based criteria. As the various portions mandated by the 1990 CAA Amendments are promulgated by the EPA, the number of regulated pollutants has continued to grow. These pollutants may be emitted from many different sources, such as the use of solvents in paint, automobile maintenance, and metals and organic emissions from solid waste incineration activities.

The State of Alabama and the City of Huntsville have adopted the NAAQS. Redstone Arsenal is located in Madison County, which is in the Tennessee River Valley - Cumberland Mountains Air Quality Control Region. The Madison County area has an attainment unclassified designation for all primary and secondary pollutant standards stipulated under the NAAQS. (U.S. Army Missile Command, 1994a)

Table 3-1: National and Alabama Ambient Air Quality Standards

Pollutant	Averaging Period[a]	Ambient Air Quality Standards (ug/m^3)[b]	Background Concentration (ug/m^3)
Sulfur Dioxide	3 hours	---	---
	24 hours	365	86
	Annual	80	---
Total Suspended Particulates (PM-10)	24 hours	150	36
	Annual	50	---
Carbon Monoxide	1 hour	40	6.5
	8 hours	10	5.0
Ozone	1 hour	235	1.0
Nitrogen Dioxide	Annual	100	---
Lead	Calendar quarterly mean	1.5	---

[a] - Arithmetic average except in the case of total suspended particular matter
[b] - Expressed in micrograms per cubic meter

3.2 BIOLOGICAL RESOURCES

Region of Influence - The ROI for biological resources is Redstone Arsenal.

Affected Environment - This section describes the biological resources of RSA by major biotic habitat. Threatened and/or endangered species or species with unique habitats are specifically addressed. Information in this section comes from existing documentation and has not been completely field verified. Though no exhaustive inventory of the flora and fauna of RSA has been done, the Nature Conservancy, through its Alabama Natural Heritage Program℠ (ALNHP℠), has conducted a biological inventory of the Arsenal. This inventory was performed to determine the presence or potential presence of federally listed or rare species of plants and animals (ALNHP℠, 1995). A summary table of ecological resources is available in Appendices E through K of the October 1995 ALNHP℠ document.

Terrestrial and aquatic resources on the Arsenal include vegetation and wildlife communities in a variety of ecological associations. Several federal agencies oversee various aspects of biological resource management. The Endangered Species Act (ESA) declares that it is the policy of Congress that all federal departments and agencies shall seek to conserve threatened and endangered species. Further, the ESA directs federal agencies to use their authorities in the furtherance of the purposes of the ESA.

Ecologically sensitive areas have been identified on the Installation (Table 3-3) that support both listed and candidate species on the federal and state levels. These communities would be managed for the conservation of biological diversity under the ESMP.

Vegetative Communities - The Arsenal is a single tract of land encompassing approximately 38,000 acres diverse in both topography and vegetation. Elevations range from approximately 560 feet above mean sea level (msl) in bottomlands to 1,200 feet msl in the mountainous regions of the Installation. Forest lands, rights-of-way, test areas, old-fields (abandoned open areas) in various stages of plant succession, in addition to developed areas, creeks, sloughs, and ponds provide for abundant diversity in wildlife and fishery habitat types on the Installation. Approximately one-third of RSA lies within the 100-year flood plain of the Tennessee River (U.S. Army Missile Command, 1994a). This habitat diversity provides for greater fish and wildlife species diversity. A comprehensive listing of the native vegetation within RSA boundaries is found in Appendix B of the *Natural Resources Management Plan for Redstone Arsenal*, July 1995.

Non-forest Lands - Hay and pasturelands encompass approximately 4,145 acres. The remaining acreage is comprised of semi-improved grounds (7,426 acres), old-field land, and wildlife openings.

Forest Lands - According to the 1988 Arsenal forest inventory, 16,180 acres (approximately 42 percent of the Arsenal) are covered in forest: approximately 4,226 acres as pines; 5,528 acres as hardwoods; 3,181 acres as mixed pine-hardwoods; and 3,245 acres as mixed cedar-hardwoods.

Pine stands located on the Installation are generally dominated by loblolly pine with some shortleaf pine. Most of the older pine stands are very dense with minimal ground cover with the exception of several stands that are extensively covered with kudzu. An estimated 2,000 acres of the open forested land is covered with kudzu that seriously threatens the natural vegetation and diversity of these areas.

Fish and Wildlife Communities - Some of the most common mammals on RSA and WNWR (approximately 4,000 acres of which are located on the Installation) are white-tailed deer, beaver, eastern cottontail rabbit, swamp rabbit, gray squirrel, fox squirrel, striped skunk, red bat, woodchuck, muskrat, opossum, raccoon, red and gray foxes, and coyote (U.S. Army Missile Command 1995; Weber 1996). A more comprehensive listing of mammals occurring on or in the vicinity of the Arsenal is given in Appendix F of the *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation*, December 1994.

Over 250 bird species are residents or migrants on RSA. As many as 100 species may be encountered year-round on RSA. A comprehensive listing of birds occurring on or in the vicinity of RSA including WNWR is presented in Appendix F of the *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation*, December 1994.

There are well over one hundred species of fish found in Installation waters. Roughly half of these are considered to be abundant or common (U.S. Army Missile Command, 1995). A comprehensive listing of fish species collected at RSA and WNWR is located in Appendix F of the *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation*, December 1994.

Reptile and amphibian species are well represented on Arsenal and WNWR lands. Fifty-one species of reptiles and twenty-nine species of amphibians are known to be present in the vicinity. A comprehensive listing of the species is given in Appendix F of the *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation*, December 1994.

Wetlands - For an area to be classified as a Clean Water Act (Section 404 [b]) jurisdictional wetland, evidence of three parameters are required (U.S. Army Corps of Engineers 1987). These parameters are the presence of hydrophytic vegetation, hydric soils, and wetland hydrology.

Wetlands are among the most biologically productive natural ecosystems in the world; comparable to tropical rain forests and coral reefs in the number and diversity of species they support. Wetlands produce great volumes of food as leaves and stems break down in the water to form detritus. This enriched material is the principal food for many aquatic invertebrates and forage fish that are food for larger commercial and recreational fish species.

Wetlands are critical to the survival of a wide variety of animals and plants, including numerous threatened and endangered species. For many species such as the wood duck, muskrat and swamp rose, wetlands are primary habitats. For others, wetlands provide important seasonal habitats where food, water, and cover are plentiful. In their natural condition, wetlands also provide flood protection, shoreline erosion control, natural products for human use, water quality improvement, and opportunities for recreation, education, and research.

A detailed jurisdictional wetland map for the Installation is not available. National Wetlands Inventory (NWI) maps for wetland types in Madison County have been prepared by the U.S. Fish and Wildlife Service. These non-jurisdictional maps were constructed from interpretations of aerial photography and were verified by spot ground-truthing. Recent work done by Geonex Corporation (1995) reports the total wetland acreage of the Arsenal to be 9,889.5 acres.

Wetlands on RSA are home to a large number and variety of plant and animal species. About 26 percent of the Installation is covered by wetlands. The wetlands are mostly associated with creeks or spring runs that are easily affected by the elevation of the Tennessee River (Weber 1996) and have bottomland hardwood forests associated with the Tennessee River and its major tributaries. About half of the Arsenal's wetlands are under WNWR jurisdiction. Redstone Arsenal's obligation is to oversee construction projects near any wetlands and to provide protection for both WNWR and Installation wetlands and mitigate any problems caused by construction in or near these areas.

Aquatic Resources - Redstone Arsenal is located on the north bank of the Tennessee River about 46 miles above Wheeler Dam and 17 miles downstream from the Guntersville Dam. Over 10,000 acres of the Arsenal are affected by high stages of the Tennessee River and other tributary streams. (U.S. Army Missile Command 1994a) Huntsville Spring Branch originates in springs and creeks of nearby mountain slopes, and flows southward through the urban areas of the City of Huntsville. The branch then enters a swampy area in the northeast corner of the Arsenal at mile

10 and flows southwestward to join Indian Creek, a tributary of the Tennessee River. Indian Creek, which joins the Tennessee River at mile 321, extends upstream through gently rolling topography with relatively little built-up area, containing pastureland, strip-cropping, and wooded areas. The normal pool of Wheeler Lake, at elevation 556, backs into the reservation to form two permanent pools of 680 and 575 acres, at the lower end of these streams. Within the Installation boundaries, Indian Creek drains approximately 12,000 acres and Huntsville Spring Branch drains approximately 11,000 acres. McDonald Creek runs along the eastern edge of the Arsenal and drains approximately 14 square miles of the northeastern corner of the Arsenal. The southern portion of the reservation drains into the Tennessee River through smaller channels. Approximately 2,000 acres, located south of Madkin Mountain, drains into outlets constructed in conjunction with Fowler Road.

Ponds located on the Arsenal are the result of gravel excavations, quarrying operations, or are of natural origin. Some ponds are in karst basins (limestone eroded by groundwater), and others are beaver ponds. Streams have been contaminated from various sources within the watershed. Huntsville Spring Branch and Indian Creek are the largest tributaries traversing the Installation. Both empty into the Tennessee River.

Ranges of aquatic habitat types are present on RSA from small ponds and quarry pits to the Tennessee River. Little documentation of the biological characteristics of these aquatic systems exists. A listing of fish species whose ranges include RSA and WNWR is given in Appendix F of the *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation*, December 1994. This appendix also contains a listing of aquatic invertebrate species collected in Huntsville Spring Branch and Indian Creek during long-term monitoring of these streams.

Threatened and Endangered Species - Biological resources warranting special protection include threatened and endangered species. Under the Endangered Species Act, federal agencies are prohibited from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival. Alabama ranks fourth in the nation (after Hawaii, California, and Florida) in the number of federally listed endangered and threatened plants and animals (U.S. Fish and Wildlife Service, 1998). Since much of the Arsenal has not been developed, the potential is high for finding rare species of plants and animals. The State of Alabama classifies federally listed threatened and/or endangered species found in the state collectively as “Alabama Protected” species (Guyse 1996).

Table 3-2 lists floral and faunal species whose accepted ranges overlap RSA and are considered threatened or endangered by either state or federal wildlife authorities.

Table 3-2: Federally Listed Endangered and Threatened, Alabama Protected, and Special Concern Species Occurring on Redstone Arsenal

SPECIES	STATUS
Gray bat - *Myotis grisescens*	Federal - Endangered State – Protected
Bald eagle - *Haliaeetus leucocephalus*	Federal - Formerly Threatened State – Protected
Peregrine falcon - *Falco peregrinus anatum*	Federal – Formerly Endangered State – Protected
Alabama cave shrimp - *Palaemonias alabamae*	Federal - Endangered State – Protected
American alligator - *Alligator mississippiensis*	Federal - Threatened due to similarity of appearance
Tuscumbia darter - *Etheostoma tuscumbia*	Federal Species of Concern State – Protected
Price’s potato-bean - *Apios priceana*	Federal - Threatened
American ginseng - *Panax quinquefolius*	Federal Candidate Category 3C State – Regulated by permit
Dwarf trillium - *Trillium pusillum* var. *alabamicum*	Federal - Species of Concern
Harper's umbrella plant - *Eriogonum longifolium* var. *harperi*	Federal - Species of Concern
Southern cavefish - *Typhlichthys subterraneus*	State – Protected
Green salamander - *Aneides aeneus*	State – Protected

Source: Soos Weber, Directorate of Environmental Management and Planning, Redstone Arsenal, Alabama, 1999

Table 3-3 lists the known locations of species and ecologically sensitive areas addressed in the ESMP.

Table 3-3: Locations of Listed Endangered, Threatened, and Candidate Species and Ecologically Sensitive Areas on Redstone Arsenal.

SPECIES	LOCATION
Gray bat - *Myotis grisescens*	Huntsville Spring Branch and Indian Creek area south of Martin Road
Bald eagle - *Haliaeetus leucocephalus*	Huntsville Spring Branch and Bradford Sinks-Swan Pond area
Peregrine falcon - *Falco peregrinus anatum*	No verified sightings on RSA.
Alabama cave shrimp - *Palaemonias alabamae*	Bobcat Cave
American alligator - *Alligator mississippiensis*	Wetland and riparian areas
Tuscumbia darter - *Etheostoma tuscumbia*	Williams Spring
Price's potato-bean - *Apios priceana*	Madkin Mountain/Gray Road extension
American ginseng - *Panax quinquefolius*	Ward, Weeden, and Madkin Mountains
Dwarf trillium - *Trillium pusillum* var. *alabamicum*	Woody/swampy habitats south of Martin Road and west of McDonald Creek, and on the eastern boundary in the bottomlands of Byrd Spring Run
Harper's umbrella plant - *Eriogonum longifolium* var. *harperi*	Lehman's Bluff, downhill from the Rustic Lodge on the bluff of the Tennessee River
Southern cavefish - *Typhlichthys subterraneus*	Matthews Cave
Green salamander - *Aneides aeneus*	Sandstone outcroppings and limestone bluffs
ECOLOGICALLY SENSITIVE AREAS	**LOCATION**
Bell Bluff and Lehman's Bluff	Cliff communities on north side of Tennessee River
Sandstone Outcroppings	Eastern edge of Test Area 5
Caves	ASP range, throughout RSA
Bradford Sinks-Swan Pond	Southwestern border of RSA
Wetland systems	Throughout RSA
Aquatic systems	Throughout RSA

Representative photographs of the plants and animals considered in this EA are presented in Figures 3-1 through 3-12.

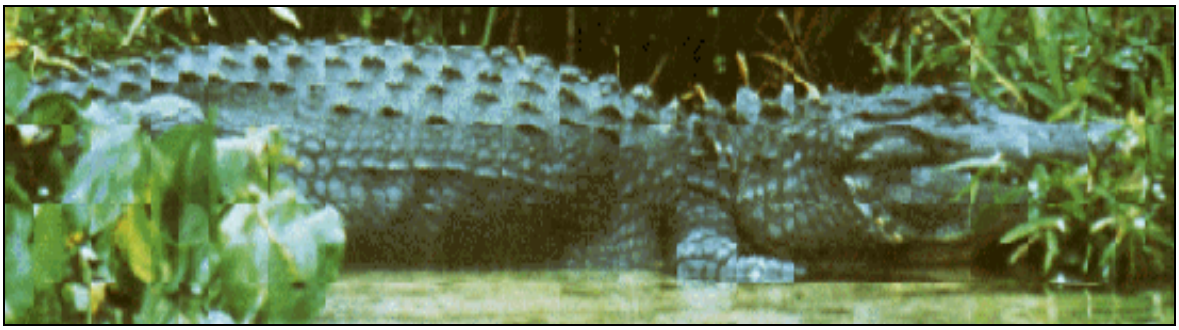

Figure 3-1 – American alligator (*Alligator mississippiensis*)
Federally listed as threatened due to similarity of appearance

Figure 3-2 – Bald eagle (*Haliaeetus leucocephalus*)
Formerly federally-listed as threatened, state protected species

Figure 3-3 – Peregrine falcon (*Falco peregrinus anatum*)
Formerly federally-listed as endangered, state protected species

Figure 3-4 – Tuscumbia darter (*Etheostoma tuscumbia*)
A federal species of concern, state protected

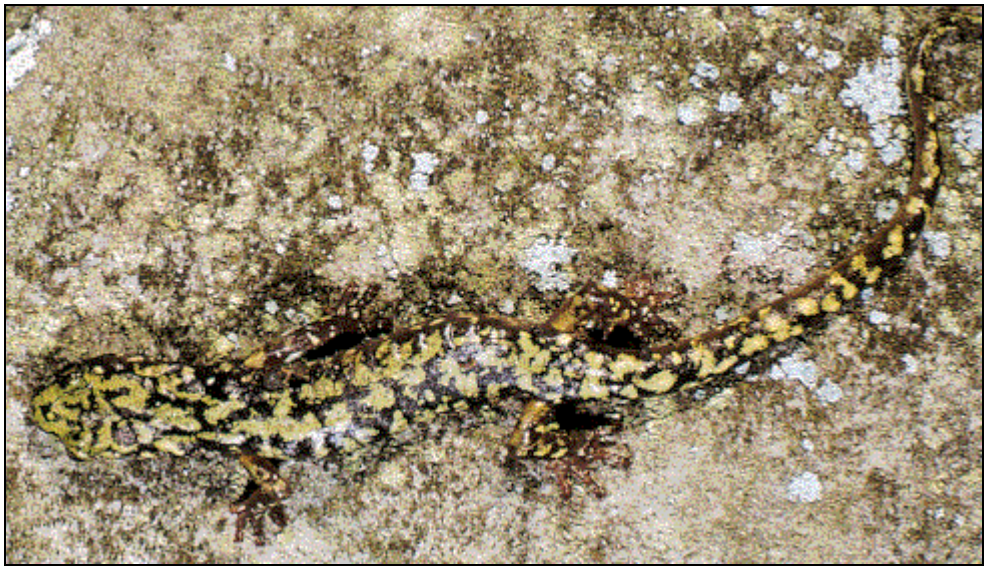

Figure 3-5 – Green salamander (*Aneides aeneus*)
State protected species

Figure 3-6 – American ginseng (*Panax quinquefolius*)
Federal Candidate Category 3C species, state regulated by permit

Figure 3-7 – Price's potato-bean (*Apios priceana*)
Federally-listed as threatened species

Figure 3-8 – Gray bat (*Myotis grisescens*)
Federally-listed endangered, state protected species

Figure 3-9 – Dwarf trillium (*Trillium pusillum* var. *alabamicum*)
Federal species of concern

Figure 3-10 – Alabama cave shrimp (*Palaemonias alabamae*)
Federally-listed as endangered, state protected species

Figure 3-11 – Harper's umbrella plant (*Eriogonum longifolium* var. *harperi*)
Federal species of concern

Figure 3-12 – Southern cavefish (*Typhlichthys subterraneus*)
State protected species

3.3 CULTURAL RESOURCES

Region of Influence - The ROI for cultural resources is Redstone Arsenal.

Affected Environment - Cultural resources consist of prehistoric and historic districts, sites, structures, artifacts, and any other physical evidence of human activity considered important to a culture or community for scientific, traditional, religious, or other reasons. Cultural resources are generally divided into three categories: archaeological (prehistoric and historic), historic resources and structures, and traditional (e.g., American Indians, Hawaiian, or other ethnic groups).

The earliest recorded archaeological work, on what is now the Arsenal, was performed in 1915. More extensive and exacting regional excavations took place in the 1930s. Phase I archaeological testing is being conducted to identify sites potentially eligible for the National Register of Historic Places (NRHP). To date, approximately 44.4 percent of the Arsenal has been surveyed (DEMP, 1999). An inventory of historical buildings and structures, fully coordinated with SHPO, was conducted for RSA in 1984 (U.S. Army Missile Command, 1994a).

The Arsenal is divided into three topographic or landform zones that possess varying degrees of archaeological potential. Zone 1 is composed of rolling land combined with flat plateaus that have undergone considerable erosion and is considered to have low to moderate archaeological potential. Zone 2 is made up of the flood plains on the Arsenal and is considered to have high archaeological potential. Zone 3 is composed of mountainous land and is considered to have low archaeological potential. (U.S. Army Missile Command, 1994a)

3.4 HAZARDOUS MATERIALS AND WASTE

Region of Influence - The ROI for hazardous materials and waste is Redstone Arsenal.

Affected Environment

Hazardous Materials - A variety of regulatory agencies define hazardous materials for specific situations. The broadest and most applicable is the Department of Transportation (DOT) definition for transportation of these materials. DOT defines a hazardous material as a substance or material that is capable of posing an unreasonable risk to health, safety, or property when transported in commerce (49 CFR 171.8).

Several federal agencies oversee various aspects of hazardous material usage. DOT regulates the packaging and transporting of hazardous materials, under 49 CFR parts 171 through 180 and Part 397. The Occupational Safety and Health Administration (OSHA) regulates the use of hazardous materials in the workplace in 29 CFR, primarily Part 1910. The EPA regulates environmental safety and public health issues associated with hazardous materials.

Hazardous Waste - Waste materials (defined in 40 CFR 261.2) include materials that are both solid and liquid (but contained). Hazardous waste is further defined in 40 CFR 261.3 as any solid waste, not specifically excluded, which meets specific concentrations or has certain toxicity, ignitability, corrosivity, or reactivity characteristics.

Hazardous waste oversight is provided primarily by EPA under the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation, and

Liability Act (CERCLA); and the Superfund Amendments and Reauthorization Act (SARA). EPA regulations are found in 40 CFR. DOT regulates transportation of hazardous waste under 49 CFR. AR 200-2 and RSA RCRA Part B Permit govern Redstone Arsenal's hazardous and toxic waste operations.

3.5 HEALTH AND SAFETY

Region of Influence - The ROI for health and safety is Redstone Arsenal.

Affected Environment - Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect one or more of the following:

- The well-being, safety, or health of workers - Workers are considered to be persons directly involved with the operation producing the effect or who are physically present at the operational site.
- The well-being, safety, or health of members of the public - Members of the public are considered to be persons not physically present at the location of the operation, including workers at nearby locations who are not involved in the operation and the off-installation population.

The standards applicable to the evaluation of health and safety effects differ for workers and the public; thus, it is useful to consider each separately.

OSHA is responsible for protecting worker health and safety in non-military workplaces. OSHA regulations are found in 29 CFR. For Army operations, AR 385-100, *Safety*, establishes the basis for worker safety programs.

Protection of public health and safety is an EPA responsibility (mandated through a variety of laws - e.g., RCRA, CERCLA/SARA, CWA and the CAA). EPA regulations are found in 40 CFR. Additional safety responsibilities are placed on DOT (for transportation issues [49 CFR]), DoD, and the Department of the Army (program requirements established in AMC 385-100).

3.6 INFRASTRUCTURE AND TRANSPORTATION

Region of Influence - The ROI for infrastructure and transportation is Redstone Arsenal.

Affected Environment - Infrastructure includes facilities and systems providing power, water, wastewater treatment, and collection and disposal of solid waste. Transportation includes the modes of transportation (road, air, and rail) that provide circulation within and access to the Installation. Only surface road access will be discussed under transportation for this EA, since there are no predominant rail or marine facilities on the Installation and the airfield is not used as a transportation center.

3.7 LAND USE

Region of Influence - The ROI for land use is Redstone Arsenal.

Affected Environment - A *Real Property Master Plan, Land Use Analysis for Redstone Arsenal* was prepared for the Arsenal's Directorate of Environmental Management and Planning (DEMP) in April of 1999. This plan assists in planning for future growth and development, and promotes compatible and coordinated uses of land. The land on the Arsenal is divided into fourteen major use areas: family housing, troop housing, community facilities, recreation, administration, training facilities, operational facilities, operational maintenance facilities, production facilities, research and development facilities, test areas, storage, post maintenance and utilities, and the National Aeronautics and Space Administration (NASA) Marshall Space Flight Center. (DEMP, 1999)

Table 3-4 quantifies current land use on the Arsenal. Ownership of Arsenal land is as follows: Army (30,910 acres), the WNWR (4,085 acres), and the Tennessee Valley Authority (2,905 acres). (U.S. Army Missile Command, 1995)

Table 3-4. Current Redstone Arsenal Land Use

LAND USE CATEGORY	APPROXIMATE ACREAGE	PERCENT OF TOTAL
Family Housing	463	1.2
Troop Housing	40	0.1
Community Facilities	270	0.7
Recreation	2,183	5.7
Administration	1,285	3.4
Training Facilities	6,727*	17.7
Operational Facilities	1,784	4.7
Operational Maintenance Facilities	644	1.7
Production Facilities	3,056	8.0
Research and Development Facilities	424	1.1
Test Areas	14,718	38.8
Storage	2,350	6.2
Post Maintenance and Utilities	293	0.8
Marshall Space Flight Center (NASA)	1,826	4.8
Roads, Rights-of-Way, and Undefined	1,905	5.0
Total	**37,968***	**100.0**

Source: Redstone Arsenal Installation Land Use Plan
* Includes 58 acre plot outleased by RSA to U.S. Army and Naval Reserve Centers

The agricultural leasing and grazing program has been ongoing on the Arsenal since shortly after World War II. Currently, there are 5,413 acres of available agricultural land leased to private individuals under five year contracts for production of hay crops and pasture (cattle grazing). There are 4,843 acres used for cattle grazing and 570 acres for hay crops. Proper coordination between the military and the lessees has served to keep idle lands to a minimum. (U.S. Army Missile Command, 1995)

According to the 1988 Redstone Arsenal forest inventory, 16,180 acres (approximately 42 percent of the Arsenal) are covered in forest: approximately 4,226 acres as pines, 5,528 acres as hardwoods, 3,181 acres as mixed pine-hardwoods, and 3,245 acres as mixed cedar-hardwoods.

Elevations on RSA range from 556 to 1,239 feet. Approximately one-third of RSA lies within the 100-year flood plain of the Tennessee River. (U.S. Army Missile Command, 1994a)

3.8 NOISE

Region of Influence - The ROI for noise is Redstone Arsenal.

Affected Environment - The principal sources of noise on the Arsenal are rocket motor flight test and static firings, warhead detonations/impacts, gun firings, demolition, and airfield operations. Significant buffer zones exist between noise producing activities and the nearest population centers (U.S. Army Missile Command, 1994a).

The Installation Compatible Use Zone (ICUZ) Program identifies noise generating areas and the magnitude of their environmental impact, and minimizes encroachment of noise sensitive activities both on and off the Arsenal (U.S. Army Missile Command, 1994a). Noise complaints are investigated and lessons learned applied to the Arsenal's test and training activities. Noise complaints, even inside the Arsenal boundary, have historically been minimal. (U.S. Army Missile Command, 1993)

3.9 GEOLOGY AND SOILS

Region of Influence - The ROI for geology and soils is Redstone Arsenal.

Affected Environment - The topography of RSA is gently rolling with elevations generally in the range of 600 to 650 feet MSL. The terrain generally slopes southward towards the Tennessee River. High areas on the Arsenal include Weeden and Madkin Mountains in the north-central portion of the Arsenal, with elevations up to approximately 1,200 feet above MSL. Bluffs such as Lehman's and Bell's along the Tennessee River are listed as outstanding natural areas (ANHP, 1995). Low areas, comprised of valleys and floodplains along the Tennessee River and its tributaries to the north, are characterized by elevations of approximately 560 feet above MSL. (U.S. Army Missile Command, 1994a)

Geology - The geologic formations in Madison County are sedimentary in origin and were formed either by the accumulation of fragments of previously existing rocks, by the accumulation of organic matter, or by chemical precipitation. The principal sedimentary rock types found in Madison County are shale, sandstone, limestone, dolomite, and chert. (U.S. Army Missile Command, 1994a)

The Tuscumbia Limestone underlies most of Redstone Arsenal. This limestone has an average thickness of 150 feet; consist of gray, medium to coarse-grained, fossiliferous limestone; and locally may contain chert nodules. The Fort Payne Chert, the Chattanooga Shale, and other, older geologic units successively underlie the Tuscumbia Limestone. The Fort Payne Chert is generally 155 to 185 feet thick and consists of alternating beds of bluish-gray chert and fine to coarse-grained, fossiliferous limestone. The Chattanooga Shale is approximately 10 feet thick and consists of dark gray to black shale. (U.S. Army Missile Command, 1994a)

Overlying the Tuscumbia Limestone, from oldest to youngest, are the Ste. Genevieve Limestone, Hartselle Sandstone, and Bangor Limestone, all Upper Mississippian in age. The Ste. Genevieve Limestone forms the slopes of the mountains and higher elevations above the Tuscumbia formation within the southern part of the Arsenal. This formation is composed of gray, thick-

bedded oolitic limestone. The Hartselle Sandstone forms the top of Bradford Mountain and forms concentric bands around Madkin and Weeden Mountains. Tan, fine-grained, fossiliferous sandstone with some siltstone and shale make up the Hartselle formation. Bangor Limestone caps the Madkin and Weeden Mountains, which is comprised of gray, crystalline, oolitic, fossiliferous limestone. (U.S. Army Missile Command, 1994a)

The surface geology of Madison County consists of unconsolidated sedimentary material overlying the rock formations. The unconsolidated material, called "regolith," is mainly derived from the weathering of the bedrock. Regolith, derived from the Tuscumbia Formation, consists of moderate red to moderate reddish-orange clay and porous, powdery rectangular to irregular blocks of chert. Dense chert or rectangular blocks of fossiliferous chert are also present due to the weathering of the Fort Payne Chert immediately underlying the Tuscumbia Formation. Regolith thickness varies from 20 to 40 feet in the northeastern part of the Arsenal to as much as 80 feet in the southern and western parts. (U.S. Army Missile Command, 1994a)

Soils - According to the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Madison County, a total of 94 soil phases representing 39 different soil series are mapped within Arsenal grounds (SCS, 1980). The predominant soil type mapped for the Arsenal consists of a deep, well-drained to moderately well-drained, silt loam to silty clay loam. These soils typically possess a loamy surface horizon underlain by a loamy to clayey subsoil layer with lenses of silty and/or sandy clay. Rock fragments generally occur throughout the clayey material. The soil colors range from a brownish-red in the northern portion to a brownish-gray in the southern portion of the Arsenal. Darker gray soils are found in areas of topographic lows. Soil depths range from very shallow on the mountains to much deeper along the larger tributaries of the Tennessee River where broad floodplain areas have been formed by the river and its tributaries. No significant mineral deposits are known to exist on Redstone Arsenal, although several limestone quarries were worked on Madkin Mountain (U.S. Army Missile Command, 1994a).

Of the 94 soil phases mapped for the Arsenal, 52 of these phases representing two soil series are listed as potential prime farmland by the USDA, SCS (SCS, 1980). These prime farmland soils are located throughout a large portion of the level to gently sloping areas of the Arsenal, including uplands, foot slopes, stream terraces, and floodplains. Within areas of the Arsenal that are mapped as prime farmland, contiguous units of ten acres or more of urban or built-up land are excluded. Additionally, areas mapped as Egam silty clay loam or Ennis silt loams are also excluded as prime farmlands, where flooding during the growing season is more than once in two years. However, the SCS has determined that the prime farmland areas at the Installation are excluded from consideration as prime farmland per the Farmland Protection Policy Act. Federal and urban lands are excluded from consideration as prime farmlands per Farmland Protection Policy Act Public Law 97-98. This determination was made in accordance with guidelines provided in the National Agricultural Land Evaluation and Site Assessment Handbook, Section 601.04 (d), Lands to be Considered (U.S. Army Missile Command, 1994a).

3.10 SOCIOECONOMICS

Region of Influence - The ROI for socioeconomics is Redstone Arsenal and the Madison County area. Socioeconomics within this EA is concerned with population, employment, and recreation for the area as well as the economic impacts to the Arsenal from grazing, timber cutting, and associated agricultural lease activities.

Affected Environment – Huntsville, although at one time a rural town, has emerged as a center for military and space technology with the center of activity in the region located at RSA. This has occurred with the consolidation of Research and Development activities for Army rocket and missile projects at the Arsenal that continues to contribute to the region's economy. The Arsenal's presence has led to the convergence of a large number of defense contractors in the Madison County area. (U.S. Army Missile Command, 1994a)

Redstone Arsenal, as a major employer in Madison County, impacts the local economy through direct employment of civilian and military personnel as well as through the local procurement of goods and services. Direct employment by the Arsenal as well as employment directly generated from the Arsenal's procurement expenditures has led to an increase in the level of economic activity. (U.S. Army Missile Command, 1994a).

3.11 WATER RESOURCES

Region of Influence - The ROI for water resources is Redstone Arsenal.

Affected Environment - Water resources include both surface water and groundwater. To protect these resources, and human health, Congress has enacted the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA). The EPA has also established water quality standards to protect water resources.

Surface Water - The Tennessee River forms the southern boundary of the Arsenal. Major watercourses that flow through the Arsenal include Indian Creek, Huntsville Spring Branch, and McDonald Creek. Each of these tributaries flows generally south and then west toward the City of Triana to empty into the Tennessee River. (U.S. Army Missile Command, 1994a)

The majority of the western portion of the Arsenal is drained by Indian Creek, and the eastern half of the Arsenal is drained by Huntsville Spring Branch. Indian Creek originates north of the Arsenal in northwestern Madison County and flows southward across the Arsenal to Wheeler Reservoir. Indian Creek has been classified for fish and wildlife use by the Alabama Department of Environmental Management (ADEM). This wildlife and fish classification is based upon the presence of wastes, pH, temperature, dissolved oxygen, toxic or other deleterious substances (U.S. Army Missile Command 1994a). Huntsville Spring Branch originates from a spring in the City of Huntsville, flows southwesterly across the Arsenal and then empties into Wheeler Lake. Huntsville Spring Branch is also classified by the ADEM as a fish and wildlife use area.

The quality of the surface water varies across the drainage divide of the Arsenal. In the western half of the drainage area (including Indian Creek, western portions of the Tennessee River, and Wheeler Reservoir) the surface water is characterized as "moderately hard" to "hard," moderately high in dissolved solids, locally high in manganese, and suitable for most uses after treatment. In the eastern portion of the drainage divide (including Huntsville Spring Branch, McDonald Creek, and the eastern portion of Wheeler Reservoir) the water is characterized as "hard" to "very hard,"

locally acidic, low in dissolved oxygen, locally high in manganese, and high in biochemical oxygen demand. (U.S. Army Missile Command, 1994a)

Groundwater - The hydrogeology at the Arsenal can be characterized by three units: the regolith, the Tuscumbia/Fort Payne formation, and the Chattanooga shale. The Fort Payne chert and the Tuscumbia limestone comprise the limestone aquifer. This aquifer is characterized by abundant groundwater supplies suitable for potable and industrial uses. The upper regolith and the Chattanooga shale act as confining beds for the upper and lower boundaries of the limestone aquifer respectively. Due to this confining action of the regolith and Chattanooga shale, the limestone aquifer is under artesian conditions in many areas. Groundwater movement reflects the surface topography and is generally flowing from the north to the south towards the Tennessee River. The potentiometric surface beneath the Arsenal ranges from 560 feet above msl to greater than 600 feet above msl. The aquifers beneath the Arsenal are some of the most productive in Madison County. None of the aquifers in Madison County have been designated as sole source aquifers per Section 1424(2)g of the Safe Drinking Water Act of 1974 (U.S. Army Missile Command, 1994a).

Groundwater from shallow wells drilled into the Tuscumbia limestone generally produces good quality water that is moderate in dissolved minerals. The average pH for groundwater in Madison County is 7.5. Due to past disposal and operations at the Arsenal several areas of contaminated groundwater currently exist at the Arsenal. Several different potential contaminants are present in the groundwater in varying concentrations. These include arsenic, trichloroethylene, benzene, and dichlorodiphenlytrichloroethane (DDT). The groundwater contamination does not appear to be migrating beyond the Arsenal boundaries (U.S. Army Missile Command, 1994a).

CHAPTER 4.0
ENVIRONMENTAL CONSEQUENCES

This section of the EA describes the potential environmental consequences of the Proposed Action. This is done by comparing proposed project activities with the potentially affected environmental components. Sections 4.1 through 4.11 evaluate the potential environmental consequences of the proposed activity. The amount of detail presented in each section is proportional to the potential for impacts. Sections 4.12 through 4.23 discuss the following with regard to proposed project actions: cumulative impacts; mitigation measures; individuals/organizations responsible for obtaining required permits/licenses/entitlements; conflicts with federal land use plans, policies, and controls; energy requirements and conservation potential; natural or depletable resource requirements and conservation potential; irreversible or irretrievable commitment of resources; biological diversity; adverse environmental effects that cannot be avoided; the relationship between the short-term uses of the human environment and the maintenance and enhancement of long-term productivity; federal actions to address environmental justice in minority populations and low-income populations; and conditions normally requiring an environmental impact statement.

To assess the potential for and significance of environmental impacts from the Proposed Action, a list of activities necessary to accomplish the Proposed Action was first developed (Sections 1.0 and 2.0). Then the environmental setting was described, with emphasis on special environmental sensitivities (Section 3.0). Next, the program activities were compared with the potentially affected environmental components to determine the environmental impacts of the Proposed Action.

Federal environmental laws and regulations were reviewed to assist in determining established thresholds for assessing environmental impacts (if any) in fulfillment of NEPA requirements. Proposed activities were evaluated to determine their potential to result in significant environmental consequences using an approach based on the interpretation of significance outlined in the CEQ regulations for implementing the procedural provisions of the NEPA (40 CFR 1500-1508) and AR 200-2, *Environmental Effects of Army Actions* (U.S. Department of the Army, 1988).

Guidelines established by the CEQ (40 CFR 1508.27) specify that significance be determined in relationship to both context and intensity (severity). The assessment of potential impacts and the determination of their significance are based on the requirements in 40 CFR 1508.27. Three levels of impact can be identified:

- No Impact - No environmental impact is predicted.
- No Significant Impact - An environmental impact is predicted, but the impact does not meet the intensity/context significance criteria for the specific resource.
- Significant Impact - An environmental impact is predicted that meets the intensity/context significance criteria for the specific resource.

4.1 AIR QUALITY

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to air quality.

4.1.1 Proposed Action

Procedures for the management and protection of listed or candidate species, as established in the ESMP, would not significantly impact air quality at RSA. Although small amounts of fugitive dust and combustive emissions would be generated from earthwork type activities, federal and state NAAQS concentrations would not be exceeded.

While the periodically-prescribed, small-scale burning for Price's Potato-bean and Harper's umbrella plant will emit smoke, the small amount of acreage burned at any one time and the varied schedule for burning would create no significant impact to air quality. Therefore, there would be no impacts expected to air quality from the implementation of the ESMP.

4.1.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no impacts to air quality expected from this alternative.

4.1.3 Cumulative Impacts

While the periodic prescribed burning for the management of certain species, as described in the ESMP, will emit smoke, cumulative impacts are not expected to air quality because of the small acreages burned at any one time. There are also no additional past, present, or reasonably foreseeable actions associated with the ESMP that would create cumulative impacts to air quality.

4.1.4 Mitigation Measures

Since the periodic prescribed burning on the Arsenal will emit smoke, mitigation measures for air quality would include limiting burning activities to small acreages at any one time and varying the burn schedule. In addition, following the prescribed burning procedures, as described in the ESMP, would ensure compliance with state and local requirements/ordinances.

4.2 BIOLOGICAL RESOURCES

Criteria for determining the significance of potential impacts to biological resources are based on the relative importance of the resource, the quantity of the resource that would be impacted, the sensitivity of the resource to the proposed activities, and the duration of the impact. Impacts are considered significant if they are determined to have the potential to cause a reduction of the population size of federally listed or state protected threatened or endangered species, degradation of biologically important unique habitats, or substantial long-term loss of vegetation and the capacity of a habitat to support wildlife.

Biological diversity (biodiversity), or the variety of life and its processes, is a basic property of nature that provides enormous ecological, economic, and aesthetic benefits. The loss of

biodiversity is recognized as a major national, as well as global concern, with potentially profound ecological and economic consequences. The purpose of the ESMP is to protect the threatened, endangered, and proposed species and to preserve and enhance their critical habitat if such is designated by the U.S. Fish and Wildlife Service (USFWS). Implementation of this plan would also enhance the Installation's biodiversity.

The following sections describe the potential impacts to biological resources from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to biological resources.

4.2.1 Proposed Action

The Proposed Action is to implement the ESMP in a timely, consistent, and effective manner and ensure the wise protection, use, and management of listed endangered, threatened, and candidate species within the Installation. By using a coherent management system, existing biological resources would be protected from encroachment by Installation activities. Implementing the ESMP would improve sustainability of listed endangered, threatened and candidate species as well as maintain the biodiversity of ecologically sensitive areas on the Installation, resulting in overall positive benefits for all of the biological resources on the Arsenal.

Vegetative Communities

The 1999 Redstone Arsenal Master Plan identified all wetlands as environmentally restricted areas for planning purposes. Furthermore, the Huntsville Spring Branch and the Bradford Sinks-Swan Pond area have been designated as ecologically sensitive areas. As such, the forested corridors will be protected and maintained along the waterways on the Installation. In addition to forest cover, the diversity of aquatic and emergent vegetation in the shallow-water ponds, sloughs, and swamps will be protected. Indigenous species in these areas include water tupelo, water hickory, overcup oak, buttonbush, marsh St. John's wort, false nettle, spadderdock, arrowhead, rose mallow, and cattail. Dwarf trillium (a federally-listed species of concern) is found in the Huntsville Spring Branch area, and would be included in this vegetation management area. These areas serve as sources of food and/or suitable habitats for the gray bat (a federally-listed endangered species), peregrine falcon (a federally-listed endangered species currently being considered for de-listing), American alligator (a former federally-listed species), and bald eagle (a former federally-listed threatened species).

Under the management prescription for the pasture land and groundwater recharge areas in the vicinity of Bobcat Cave (Area 101), where populations of the Alabama cave shrimp have been observed, approximately 100 acres of pasture would be planted with hardwood trees, changing the area from agricultural leased land to non-commercial forestland. This would protect the habitat from degradation or groundwater contamination resulting from farming/cattle grazing activities.

Under the ESMP, American ginseng (a federal candidate species) populations will be monitored by DEMP personnel to ensure its continuance in the vegetative communities on Weeden and Ward Mountains in the north-central portion of the Arsenal.

Prescribed burning is essential for maintaining the population of Price's potato-bean (a federally-listed threatened species) and Harper's umbrella plant (a federal species of concern). In addition

to increasing the vigor and/or reproduction rate of these plants, prescribed burning can open park-like stands, maintain natural openings, and renew herbaceous vegetation. When these areas are interspersed with numerous small streams or branch bottoms, ravines, and scrub oak ridges, opportunities for management are unlimited.

No negative environmental impacts are anticipated to the vegetative communities of RSA as a result of implementation of the ESMP.

Fish and Wildlife Communities

In addition to the listed endangered, threatened and candidate fish and wildlife species found on RSA, the conservation of many other species animals would occur with the implementation of the ESMP. The preservation of caves, such as Bobcat Cave, as ecologically sensitive areas will also contribute to the conservation of the southern cavefish, the cave crayfish, and various species of bats that may potentially inhabit these caves.

In order to conserve the gray bat population, their foraging habitat would be protected at RSA with the implementation of the ESMP. This management activity would ensure that the aquatic insects upon which the bats depend (particularly flies, mayflies, and beetles) are available for foraging animals. Additionally, the habitats that serve as corridors for feeding and roosting sites for the bald eagle, American alligator and peregrine falcon would be protected to aid in the conservation of these populations. Likewise, the protection of these bottomlands and riparian zones would conserve the hundreds of other species that are associated with these communities.

The ecologically sensitive areas designated on the Installation often provide critical habitats for a variety of species. The protection of the ecologically sensitive Williams Spring area would aid in the conservation of the Tuscumbia darter (a federal species of concern). In addition, the significant forest cover in this area is critical for suitable habitat for the various neotropical migrant song birds that transit the Arsenal during the year.

The sandstone outcroppings found on the ecologically sensitive Bell Bluff area provide the necessary habitat for both the green salamander and the Allegheny woodrat, both of which are state protected species.

Management procedures outlined in the ESMP would not be expected to result in negative impacts to any fish and wildlife communities on RSA.

Aquatic Resources

Aquatic resources on the Arsenal would benefit from the implementation of the ESMP. Aquatic resources in the immediate vicinity of listed endangered, threatened, or candidate species would be protected from potential sources of contamination, and water quality would be monitored.

Threatened and Endangered Species

There would be positive impacts to threatened and endangered species with the implementation of the ESMP. All species considered in the ESMP would be protected from any activities that would jeopardize their continued existence, and efforts would be made to preserve and enhance the presence of these species and any designated critical habitat on RSA.

4.2.2 No-Action Alternative

If the No-Action Alternative were chosen, the ESMP would not be implemented. There would be no concise, comprehensive, operating procedures in place to manage the listed endangered, threatened, and candidate species found on RSA. In the absence of protection for endangered/threatened/candidate species, the sustained biodiversity, ecological integrity and long-term health of these resources on the Installation could suffer. Additionally, the conservation of biodiversity including the protection of threatened and endangered species is a mandated compliance issue with which all Army installations are required to comply. Failure to implement this ESMP could result in violation of the Endangered Species Act, and could subsequently result in civil and criminal penalties, including incarceration.

Significant adverse impacts may be anticipated to valuable resources if the No-Action Alternative were chosen.

4.2.3 Cumulative Impacts

There would be positive cumulative impacts expected to biological resources and biodiversity from implementing the ESMP. Endangered, threatened, and candidate species and their habitats would be protected from perturbations. This protection would also aid in the conservation of all other species and habitats found in these areas. For example, prescribed burning, as outlined in the ESMP, would improve wildlife and bird nesting cover/habitat and enhance legume seed supplies.

4.2.4 Mitigation Measures

If the Proposed Action is implemented, and the management plans as outlined in the ESMP are followed, additional mitigation measures would not be necessary. The special protection afforded to threatened and endangered species and their critical habitats would enhance the health and biodiversity of these and other biological resources for both consumptive and non-consumptive uses.

4.3 CULTURAL RESOURCES

Cultural and archaeological resources are limited, nonrenewable resources whose potential for scientific research or value may be easily diminished by actions that significantly impact the integrity of the property or through inaction to potential problems. The intensity and context of the alteration to the distinctive characteristics and integrity of the resource determine the significance of impacts to cultural resources.

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to cultural resources.

4.3.1 Proposed Action

There would be no impacts expected to cultural resources from implementing the ESMP if mitigation measures, as described below in Section 4.3.4, were followed.

4.3.2 No-Action Alternative

There would be no impacts expected to cultural resources from the No-Action Alternative.

4.3.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact cultural resources in a cumulative manner; therefore, no cumulative impacts are expected.

4.3.4 Mitigation Measures

Proposed ESMP activities that involve the movement or disturbance of earth (in or near sensitive areas), alterations to buildings or structures that might be eligible for the NRHP, impact to potential archeological sites, or other environmental impacts are examined by a Project Review Committee, which includes the Arsenal's NEPA Coordinator and a Master Planning Division representative. Plowing, disking, or other type of excavation would not be performed without prior written approval of the Arsenal's Cultural Resources staff. Coordinated consultation activities with ALSHPO would continue to determine their concerns regarding the Proposed Action.

If, during ESMP activities on RSA, government personnel and contractors observe items that might have historical or archaeological value, such observations will be reported immediately to RSA personnel so that the Cultural Resources Manager may determine their significance and any special disposition of the finds. Activities in the area of the discovery that may result in the destruction of these resources would cease and personnel would be prevented from trespassing on, removing, or damaging such resources.

4.4 HAZARDOUS MATERIALS AND WASTE

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to hazardous materials and waste.

4.4.1 Proposed Action

There would be no impacts expected from hazardous materials and waste from implementing the ESMP. The Proposed Action is to implement the ESMP in a timely, consistent and effective manner and ensure the wise protection of threatened and endangered species. Hazardous materials (e.g., fertilizers and pesticides) may potentially be used in or near areas inhabited by endangered, threatened, or candidate species. Application of fertilizers or pesticides would adhere to guidelines and procedures as outlined in the *Installation Pest Management Plan* (DEMP, 1998). This would ensure the proper use and disposal of these materials to avoid any adverse impacts to any listed endangered, threatened, or candidate species on the Arsenal.

4.4.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no impacts to hazardous materials and waste expected from the No-Action Alternative.

4.4.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions associated with the ESMP that would be expected to impact hazardous materials and waste in a cumulative manner; therefore, no cumulative impacts are expected.

4.4.4 Mitigation Measures

No mitigation measures associated with the ESMP are necessary for hazardous materials and waste.

4.5 HEALTH AND SAFETY

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to health and safety.

4.5.1 Proposed Action

There would be no impacts to health and safety expected from implementation of the ESMP.

4.5.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no impacts to health and safety expected from the No-Action Alternative.

4.5.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact health and safety in a cumulative manner; therefore, no cumulative impacts are expected.

4.5.4 Mitigation Measures

No mitigation measures associated with the ESMP are necessary for health and safety.

4.6 INFRASTRUCTURE AND TRANSPORTATION

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to infrastructure and transportation.

4.6.1 Proposed Action

There would be no significant impacts expected to infrastructure and transportation from implementing the ESMP. Access to some areas in the vicinity of the protected species listed in the ESMP would be restricted. According to DEMP personnel, routine access to these areas is not considered critical to the Installation's mission or other infrastructure or transportation needs.

4.6.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. This alternative would have no impact on infrastructure and transportation on Redstone Arsenal.

4.6.3 Cumulative Impacts

There would be no cumulative impacts expected to infrastructure and transportation from implementing the ESMP.

4.6.4 Mitigation Measures

No mitigative measures are identified or necessary for infrastructure and transportation resources.

4.7 LAND USE

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to land use.

4.7.1 Proposed Action

There would be potential, though non-significant, impacts expected to land use from implementing the ESMP. These impacts are primarily associated with the change in land use around areas associated with the species listed in the ESMP. Some examples are:

- changing land use from commercial agricultural lease to noncommercial forestry in the vicinity of Bobcat Cave
- closure of a dead-end road on Madkin Mountain in the area where the Price's potato-bean has been found
- restricting training uses to low impact methods
- restricting vehicle uses to existing roads

Use of the ESMP would result in effective, economical, and environmentally acceptable land use that is protective of listed endangered, threatened, or candidate species on the Arsenal and would be instrumental in maintaining compliance with pertinent laws and regulations. Good land use management practices would allow underutilized areas to be revegetated/reforested to increase the habitat available for use by sensitive floral and faunal species.

4.7.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no guidance for compatible land use and ESMP goals. Potential impacts to protected species could be expected to occur.

4.7.3 Cumulative Impacts

There would be no cumulative impacts expected to land use from implementing the ESMP. Only minor, localized, impacts to land usage would be realized by implementing the ESMP. Adherence to the development constraints outlined in the 1999 Installation Real Property Master Plan Land Use Analysis would ensure adequate availability of land for current and future mission needs as well providing areas for housing, recreation, and species conservation.

4.7.4 Mitigation Measures

Installation environmental personnel would coordinate with land users to ensure awareness of protected species in training areas. Training/guidance would be provided to enable identification and avoidance of these species by land users.

4.8 NOISE

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to noise.

4.8.1 Proposed Action

There would be no impacts to noise expected from implementing the ESMP.

4.8.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no impacts to noise expected, as there would be no change to the general types of activities in the area.

4.8.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact noise in a cumulative manner; therefore, no cumulative impacts are expected.

4.8.4 Mitigation Measures

No mitigative measures are identified or necessary for noise impacts from the ESMP.

4.9 GEOLOGY AND SOILS

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to geology and soils.

4.9.1 Proposed Action

There would be no impacts expected to geology and soils from implementing the ESMP.

4.9.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no impacts to geology and soils from the No-Action alternative.

4.9.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions associated with the Proposed Action that would be expected to impact geology or soils.

4.9.4 Mitigation Measures

No mitigative measures associated with the Proposed Action are identified or necessary for geology and soils on RSA.

4.10 SOCIOECONOMICS

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to socioeconomics.

4.10.1 Proposed Action

The Proposed Action is to implement the ESMP in a timely, consistent, and effective manner. There would be no impacts expected to socioeconomics from the implementation of the ESMP. No additional personnel are anticipated to be required for the implementation of the plan and there would be no impacts to population or employment in the region.

4.10.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no impacts to population or employment in the region under the No-Action Alternative.

4.10.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact socioeconomics in a cumulative manner, therefore, no cumulative impacts are expected.

4.10.4 Mitigation Measures

No mitigation measures are anticipated for socioeconomics.

4.11 WATER RESOURCES

The following sections describe the potential impacts to the environment from the Proposed Action and the No-Action Alternative, cumulative impacts, and potential mitigation measures pertaining to water resources.

4.11.1 Proposed Action

There would be potential positive impacts to water resources from implementing the ESMP. A positive impact would be realized from the protection of groundwater in the approximately 160-acre watershed in which Bobcat Cave, habitat of the Alabama cave shrimp, is located. The ESMP proposes a monthly monitoring of groundwater water quality in the watershed via two groundwater monitoring wells proposed for installation by the ESMP. This monitoring would allow potential groundwater contamination to be detected early and allow for corrective measures to be taken to limit adverse impacts to the shrimp.

4.11.2 No-Action Alternative

If the No-Action alternative were chosen, the ESMP would not be implemented. There would be no anticipated impacts to water resources from the No-Action alternative.

4.11.3 Cumulative Impacts

There would be no cumulative impacts to water resources expected from implementing the ESMP.

4.11.4 Mitigation Measures

No mitigation measures for water resources have been identified or are necessary for protection of water resources if the ESMP is implemented.

4.12 INDIVIDUALS/AGENCIES RESPONSIBLE FOR OBTAINING REQUIRED PERMITS/LICENSES/ENTITLEMENTS

The U.S. Fish and Wildlife Service must approve the proposed ESMP for RSA through the Section 7 consultation under the Endangered Species Act and the Alabama Department of Conservation and Natural Resources (ADCNR). Upon agency and RSA Installation Commander approval, DEMP will incorporate the ESMP into RSA's Integrated Natural Resources Management Plan. The ESMP will be reviewed annually and updated to ensure conservation goals are met and information is current. (Draft Endangered Species Management Plan for Redstone Arsenal, Alabama, 1999)

4.13 CONFLICTS WITH FEDERAL, STATE, OR LOCAL LAND USE PLANS, POLICIES, AND CONTROLS

The proposed ESMP for Redstone Arsenal does not present any conflicts with federal, regional, state, or local land use plans, policies, or controls.

4.14 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Anticipated energy requirements of ESMP activities can be accommodated within the current energy supply for RSA. Energy requirements would be subject to any established energy conservation practices.

4.15 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL

No significant use of natural or depletable resources is required by the action proposed in the ESMP.

4.16 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

Although the Proposed Action would result in some irreversible and irretrievable commitment of resources such as fuel and labor, this commitment is not significantly different from that necessary for normal activities taking place on the Arsenal.

4.17 BIOLOGICAL DIVERSITY

Biological diversity (biodiversity), or the variety of life and its processes, is a basic property of nature that provides enormous ecological, economic, and aesthetic benefits. The loss of biodiversity is recognized as a major national as well as global concern with potentially profound ecological and economic consequences. Conservation of biodiversity is a national goal provided

for in the framework of NEPA. This goal is to anticipate and evaluate the effects of federal actions on biodiversity and actively manage for the reduction of the impact of these effects as well as the promotion of restoration to previously impacted areas. The basic goal of biodiversity conservation is to maintain naturally occurring ecosystems, communities, and native species. The Proposed Action evaluated in this EA, would accomplish these goals and there would be positive impacts expected to biodiversity in the ROI.

4.18 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

There are no adverse environmental effects from the Proposed Action that cannot be avoided or minimized. Adherence to the ESMP would protect the various resources located on RSA to the maximum extent possible while enhancing the sensitive habitats utilized by the resident and transient endangered, threatened, and candidate species that utilize the Arsenal.

4.19 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The productivity and future land use of RSA would not be adversely impacted by implementation of the Proposed Action. Ecologically sensitive areas (as identified in the 1999 Installation Real Property Master Plan Land Use Analysis) on RSA would be maintained to support the natural habitat of these areas.

4.20 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS

The Proposed Action would be undertaken in a manner that would not substantially affect human health or the environment. The Proposed Action would not exclude persons from participation in, deny persons the benefits of, or subject persons to discrimination under, the program actions because of their race, color, or national origin. Also, there would be no disproportionate effects to minority communities or socioeconomy.

4.21 CONDITIONS NORMALLY REQUIRING AN ENVIRONMENTAL IMPACT STATEMENT

Potential impacts from the Endangered Species Management Plan for Redstone Arsenal were evaluated in the context of the criteria for actions requiring an Environmental Impact Statement described in DoD Directive 6050.1, *Environmental Effects in the United States of Department of Defense Actions* (U.S. Department of Defense 1979), and AR 200-2, *Environmental Effects of Army Actions* (U.S. Department of the Army 1988). Specifically, the proposed project activities were evaluated for their potential to:

- significantly affect environmental quality or public health and safety;
- significantly affect historic or archaeological resources, public parks and recreation areas, wildlife refuge or wilderness areas, wild and scenic rivers, or aquifers;
- adversely affect properties listed or meeting the criteria for listing on the National Register or the National Registry of Natural Landmarks; significantly affect prime and unique farmlands, wetlands, ecologically or culturally important areas, or other areas of unique or critical environmental concern;

- result in significant and uncertain environmental effects or unique or unknown environmental risks;
- significantly affect a species or habitat listed or proposed for listing on the federal list of endangered or threatened species;
- establish a precedent for future actions;
- adversely interact with other actions resulting in cumulative environmental effects;
- involve the use, transportation, storage, and disposal of hazardous or toxic materials that may have significant environmental impact.

The evaluation indicated that the Endangered Species Management Plan for Redstone Arsenal, as described in this EA, did not significantly impact any of these criteria.

CHAPTER 5.0
CONCLUSIONS AND RECOMMENDATIONS

The impact to the environment by the ESMP for Redstone Arsenal has been assessed. A more detailed comparison of the environmental consequences of each alternative is found in Section 2.3.

Alternative 1 (Proposed Action) would most effectively manage and preserve Redstone Arsenal's endangered, threatened, and candidate species as required by federal, state, DoD, and Army regulations. With the Proposed Action, Redstone Arsenal would implement the ESMP in a timely, consistent, and effective manner. The ESMP describes the Installation's endangered (protected) species management requirements, outlines the resources necessary for proper management, and describes the administrative and environmental requirements of the program. The plan would serve as a guide for maintaining a healthy and diverse environment for the sustained survival of resident and transient endangered, threatened, and candidate species at RSA.

The Proposed Action would have potentially positive impacts to biological resources and water quality. There would be potentially non-significant negative impacts to land use. Positive cumulative impacts would also be expected for biological resources. There would be no anticipated significant adverse impacts to the other environmental resources considered. Any identified impacts to the environment are not considered to be significant and would be mitigable.

If the No-Action Alternative were selected, the ESMP would not be implemented. There would be no comprehensive endangered (protected) species management for RSA. The Arsenal would experience a possible loss of suitable and varied floral and faunal habitats including threatened and endangered species habitats, and decreased biodiversity. Under the No-Action Alternative, potential adverse impacts would be expected to biological resources, especially to protected species and their habitats.

CHAPTER 6.0
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CHAPTER 7.0
INDIVIDUALS/AGENCIES CONSULTED

7.1 Agencies/Organizations/Individuals Sent Copies of the Assessment

As part of the CEQ Regulations on the National Environmental Policy Act, the U.S. Army Aviation and Missile Command is circulating the Environmental Assessment of the Endangered Species Management Plan for Redstone Arsenal to the following agencies, organizations, and individuals.

Alabama State Historic Preservation Office, Montgomery, Alabama

U.S. Army Aviation and Missile Command, Directorate of Environmental Management and Planning, Natural Resources Team (AMSAM-RA-EMP-IR-NR), Redstone Arsenal, Alabama

U.S. Environmental Protection Agency, Atlanta, Georgia

U.S. Fish and Wildlife Service, Ecological Services Division, Daphne, Alabama

7.2 Individuals and Agencies Contributing to the Project

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CHAPTER 8.0
REFERENCES

Alabama Natural Heritage Program℠, 1995. *Draft Natural Heritage Inventory of Redstone Arsenal: Federally Listed Endangered, Threatened, Candidate, and State - Listed Species,* October 1995.

Directorate of Environmental Management and Planning (DEMP), 1998. *Installation Pest Management Plan for U.S. Army Aviation and Missile Command, Redstone Arsenal, Alabama.* October 22, 1998.

Directorate of Environmental Management and Planning (DEMP), 1999. *Real Property Master Plan, Land Use Analysis for Redstone Arsenal.* April 1999.

DoD Directive 4700.4, 1989. *Natural Resources Management Program.*

DoD Directive 6050.1, 1979. *Environmental Effects in the United States of Department of Defense Actions.*

Geonex, 1995. *Mapping Report for United States Army, Redstone Arsenal*, prepared by Geonex Corporation, St. Petersburg, Florida under Contract No. 14-16-0009-91-002.

Guyse, Keith 1996. Personal communication with Guyse, Alabama Game and Fish Commission, Wildlife Section, regarding endangered and/or threatened species listings, November 21.

U.S. Army Missile Command, 1994. *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation, Redstone Arsenal, Alabama*, December 23.

U.S. Army Missile Command, 1994a. *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation, Redstone Arsenal, Alabama*, July.

U.S. Army Missile Command, 1995. *Natural Resources Management Plan for Redstone Arsenal, Parts I, II, III, IV, V, VI,* July.

U.S. Department of the Army, 1997. *Environmental Protection and Enhancement,* Army Regulation 200-1, February 21.

U.S. Department of the Army, 1988. *Environmental Effects of Army Actions*, Army Regulation 200-2, December 23.

U.S. Department of the Army, 1995. *Natural Resources-Land, Forest and Wildlife Management,* Army Regulation 200-3, February 28.

Weber, S. 1996. Personal communication between Weber, Environmental Protection Specialist, U.S. Army Aviation and Missile Command Environmental Management and Planning Directorate, and Vista Technologies, regarding vegetative communities and wildlife species (including threatened and endangered) on Redstone Arsenal, Spring 1996.

CHAPTER 9.0
ACRONYMS AND ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
ALNHP℠	Alabama Natural Heritage Program℠
AMC	Army Material Command
AMCOM	Army Aviation and Missile Command
AR	Army Regulation
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CWA	Clean Water Act
DEMP	Directorate of Environmental Management and Planning
DDT	dichlorodiphenlytrichloroethane
DoD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FNSI	Finding of No Significant Impact
ICUZ	Installation Compatible Use Zone
msl	mean sea level
NASA	National Aeronautics and Space Administration
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_2	nitrogen dioxide
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O_3	ozone
OSHA	Occupational Safety and Health Administration
Pb	lead
PM-10	particulate matter with an aerodynamic diameter less than or equal to 10 microns
RCRA	Resource Conservation and Recovery Act
ROI	Region of Influence
RSA	Redstone Arsenal
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service (now known as the NRCS, the Natural Resources Conservation Service)
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WNWR	Wheeler National Wildlife Refuge